Amateur User-Centered Software for Creative, Diverse 3D Human Avatar Design

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ABSTRACT

This doctoral research designs 3D human avatar generation software for amateur creative users. Currently available software relies on limiting the range of possible bodies that the user is able to create, within the boundaries of normative physicality, in order to simplify interaction for users without 3D modeling skills. Rather than artificially limiting user output, I am creating open source software that expands the range of bodies able to be represented in program, following a user centered design process to implement direct manipulation techniques extrapolated from artistic practice. This paper describes the background context, aims, and current research activities related to creating this software as a PhD project.

CCS CONCEPTS

• **Computing Methodologies** → **Shape Modeling**; Mesh Models • **Interaction Design** → User Centered Design • Computers in Other Domains → *Computer Games*

KEYWORDS

Human Avatar, 3D Modeling, Diversity, Software, User-Centered Design

1 INTRODUCTION

Generating detailed, high quality mesh-based digital 3D models is known to be difficult for amateur users, and this is especially true of complex, physics-oriented human bodies [1]. Several software options are presently available for generating human avatars without requiring 3D modeling proficiency, including popular options such as Poser[1], Daz 3D[2], and MakeHuman[3], among others. Each of these software options shares similar gaps in the ability to create avatars outside of normative anatomical frameworks. This doctoral research recognizes the limitations of current software, with the aim of creating software that expands the affordances and usability of human avatar software for use in games, digital art, and animation.

2 BACKGROUND AND RESEARCH CONTEXT

2.1 Creative Context

3D avatars and modeling tools are routinely used to create games, especially in independent games and related creative fields. It is well documented that the gendered portrayals of women in mainstream games as avatars tend toward stereotypically sexualized body proportions, and that there is a consistent lack of non-white playable character avatars (outside of sports video games) [7]. Independent creators have space and potential to expand the range of games and creative content available beyond the mainstream by creating work centering marginalized experiences and characters. In this vein, Javy Gewaltney describes the potential for challenging gameplay and empathetic experience in creating a game where the player navigates a city as a wheelchair user [5]. However, the limitations of current human avatar modeling tools mean that challenges for users creating non-normative digital bodies are significant, particularly without 3D modeling experience.

2.2 Software Capabilities and Affordances

Poser and Daz prompt the user to choose a stock character to modify, while in MakeHuman, users modify the same basic avatar. In each of these pieces of software, selecting a gender for the avatar is compulsory, and this choice determines the anatomical structure of the mesh avatar, restricting

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[1] http://my.smithmicro.com/poser-11.html
[2] https://www.daz3d.com/
[3] http://www.makehuman.org/

modifications to secondary sex characteristics and genital meshes. This artificial reliance on binary gendered anatomical stereotypes presents problems for creating a variety of appearances, including but not limited to transgender avatars.

While it is possible to remove a limb's visibility in Poser 11, the 'bones' connected to the appendage remain, presenting issues when the avatar is exported, and no software currently has specific capabilities to represent a range of physically disabled bodies as avatars. MakeHuman includes race-specific sliders that modify not only the avatar's material coloring but also physical features such as eye and lip shape, body proportions, and muscle mass, reinforcing racial stereotypes. Daz 3D and Poser include a color picker model to change the chosen character's skin color, but the range of skin colors available tend heavily toward the lighter end of the spectrum.

While it could be argued that these features and restrictions may be indicative of an attempt to simplify the complex modification of a digital human form for novice users, they are also reflective of what Judith Butler describes as "the materialization of the regulatory norm", the idea that a human body must conform to norms of sex, race, and ability to be viewed as valid or whole [2, xii]. My PhD research explores methods for implementing amateur-centered, creatively focused 3D human avatar generation software, without relying on normative categories to simplify user interaction or output.

2.3   Related Work

In large part, previous research into developing usable 3D modeling interfaces for novice users has focused on modeling objects, animals, or non-humanoid creatures. Approaches like Funkhouser et al's Modeling by Example [4] and Kraevoy et al's Shuffler [6] (which does provide limited human modeling capability) prompt the user to assemble a whole from interchangeable, pre-determined segments or pieces. Such methods are less well-suited to creating a highly detailed, complex, variable humanoid model. AttribIt [3], in which sliders are used to control mesh morphing output based on descriptive adjectives (more to less dangerous being one such category), is an example of using a variety of expressive terminology and modification to stimulate user creativity in 3D modeling. Nevertheless, this approach is appropriate to decontextualized 3D objects and animals in ways that it might not be to human bodies, where classing bodies as dangerous carries racial connotations, as an example.

3   DESIGN AND APPROACH

3.1   Toward an Expressive User Interface

I am focusing my research primarily on expanding the range of possible bodies 3D human avatar generation software is able to generate accurately. Given the limitations of previous research and software, a crucial element of this research involves designing software interactions which increase usability for

amateur users, without imposing normative constraints on the user's output possibilities. These goals will be achieved by direct manipulation techniques based on physical artistic interaction, which modify adjustably detailed sections of the avatar on the on-screen display.

Figure 1: Three examples of height manipulation of an avatar in current prototype software.

The ability of the user to control the detail level of the mesh that they wish to modify, in combination with a randomization option, can allow for a range of speed and attention to detail in user workflow. I am also exploring the technical methods available to enable users to generate initial avatars from drawings and real world 3D objects, allowing multiple points of access to avatar creation [8, 10]. This design focuses on parallels between system interaction and real-world creative interaction, with the intention to facilitate comfort in digital 3D modeling by connecting the activity with users' parallel creative skillset for physical manipulation (Figure 1).

3.2   Creative User-Centered Process

Toward the aim of crafting a useful software tool for a broad range of representative creative expression, I am engaging with artists and creative practitioners at multiple levels of with the goal of designing, refining, and evaluating my software. This approach is based on interviews investigating techniques used in personal practice and pedagogical settings, across various artistic media but with particular focus on sculptural techniques. Each level of the design process is user centered, and I will work closely with users to evaluate both the usability and the usefulness of the software as a creative tool in their process [9]. Since my PhD program is practice-based and I am also an artist, critical reflection on the usefulness of the tool in my own artwork and practice is also a component of the project.

4   DIRECTION

I am currently in the first year of my research, and expect to complete my PhD around the end of 2019, with my first round of user studies beginning in April 2017. At present, I am conducting interviews with creative practitioners and producing preliminary prototypes of user avatar modification interactions based on these conversations. I am also continuing to integrate the results

and research process into my own artistic practice. Though this paper describes the scope of my overall research, I am particularly interested in feedback on the design of user interaction with mesh-based 3D modeling according to real-world artistic techniques. If selected, my presentation at MOCO 2017 will include a demo of my current prototypes at that point in my doctoral research.

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